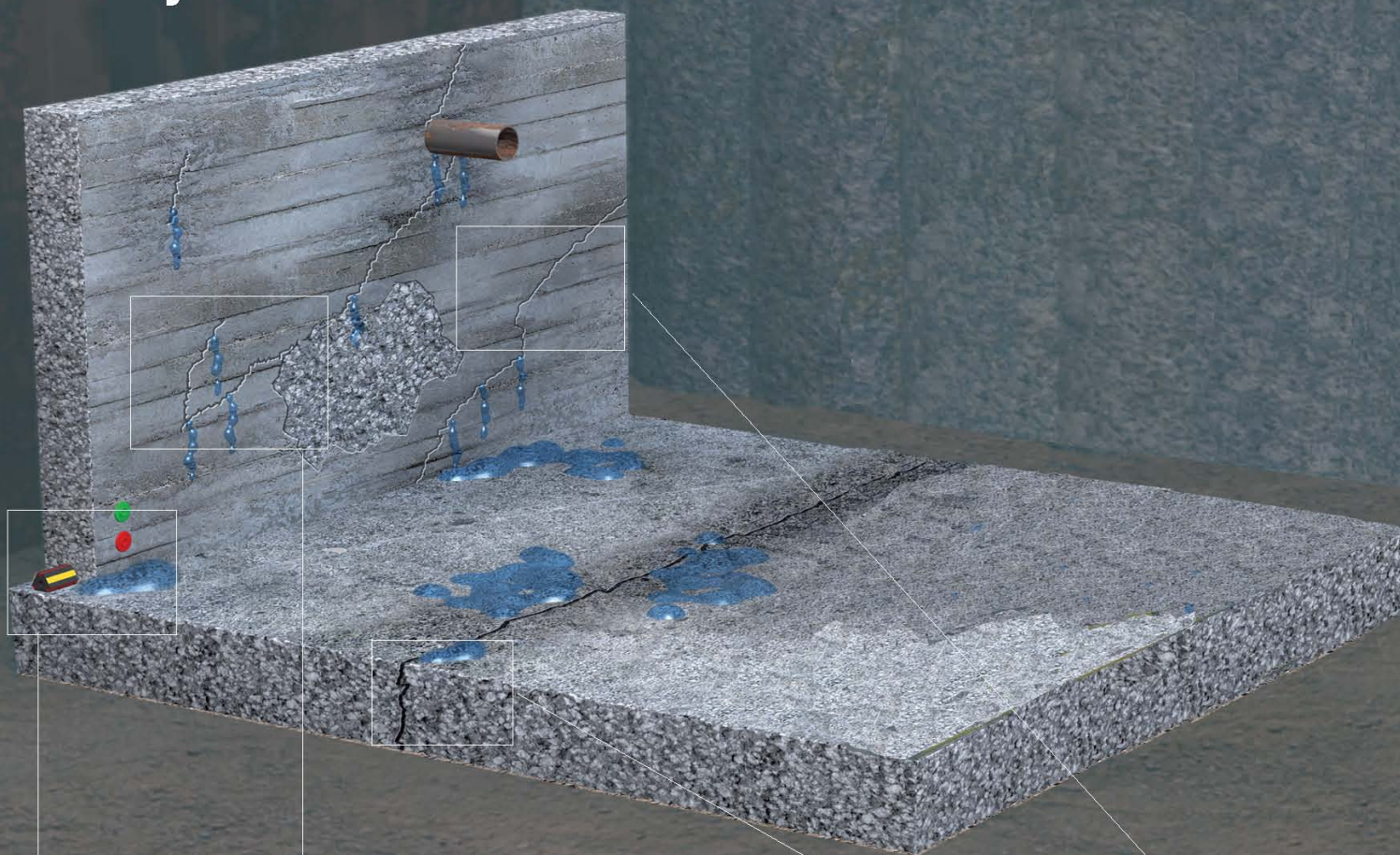




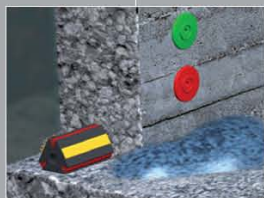
Sika® Injection Systems for Concrete Structures



Sika® Injection Systems for Concrete Structures



Typical Problems in Concrete Structures



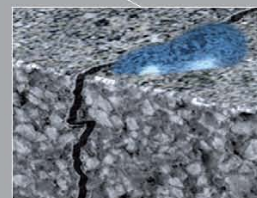
Waterproofing of Construction Joints

Sealing of construction joints in concrete structures.



Surface Sealing of leaking Concrete Structures

Remedial surface sealing by curtain injection of defects in underground building components.



Waterproofing of Cracks

Closing, sealing and flexible bridging of leaking cracks in new and existing structures.



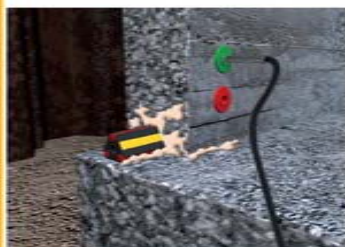
Structural Crack and Void Repair

Bridging and filling of cracks and voids where structural strength is required.

The Sika® Injection Technology

Injection Material Parameters	Reasons	Injection System Requirements	Sika's Injection Solution
Viscosity	<ul style="list-style-type: none"> ■ Better crack penetration due to low viscosity ■ Reduction of high injection pressure due to low viscosity 	<ul style="list-style-type: none"> ■ Different viscosities of injection resins for different crack widths (see table 1) ■ Low particle size of microfine binder for fine cracks 	<p>Very low Viscosity</p> <ul style="list-style-type: none"> ■ Sika® Injection-201 ■ Sika® Injection-29/-304 <p>Low Viscosity</p> <ul style="list-style-type: none"> ■ Sika® Injection-101 ■ Sikadur®-52 Injection <p>Low Particle Size</p> <ul style="list-style-type: none"> ■ Sika® InjectoCem-190
Expansion	<ul style="list-style-type: none"> ■ Better sealing result due to the self-injecting effect of expansion ■ Complete filling of fissures and voids ■ Low actual material consumption due to increased volume after expansion 	<ul style="list-style-type: none"> ■ Fast expansion ■ High foaming factor ■ Stable expansion with no shrinkage later during curing of the system ■ Temporary sealing due to high foaming factor 	<p>High and fast Expansion</p> <ul style="list-style-type: none"> ■ Sika® Injection-101
Reaction Time	<ul style="list-style-type: none"> ■ Short reaction times prevent washing out of the resin ■ Short waiting times during the works ■ Reaction only takes place when needed 	<ul style="list-style-type: none"> ■ Variable reaction times (see table 2) ■ No reaction takes place unless the resin is in direct contact with water or moisture 	<p>Short and variable Reaction Times</p> <ul style="list-style-type: none"> ■ Sika® Injection-101 ■ Sika® Injection-AC10/-AC20 ■ Sika® Injection-304
Potlife	<ul style="list-style-type: none"> ■ Long potlife means as pumpable as single component system 	<ul style="list-style-type: none"> ■ Variable potlife for different requirements (see table 3) 	<p>Long Potlife</p> <ul style="list-style-type: none"> ■ Sika® Injection-101/-201 ■ Sika® Injection-29 ■ Sikadur®-52 Injection ■ Sika® InjectoCem-190
Flexibility	<ul style="list-style-type: none"> ■ Ability to accommodate limited movement 	<ul style="list-style-type: none"> ■ Long-term flexibility after curing ■ Permanent sealing 	<p>Flexible</p> <ul style="list-style-type: none"> ■ Sika® Injection-201 ■ Sika® Injection-29 <p>High Flexibility</p> <ul style="list-style-type: none"> ■ Sika® Injection-304
Adhesion/Bond	<ul style="list-style-type: none"> ■ Structural bonding of cracks ■ Better sealing due to good adhesion 	<ul style="list-style-type: none"> ■ Excellent adhesion ■ Full bond at contact surfaces ■ No shrinkage 	<p>High Adhesion</p> <ul style="list-style-type: none"> ■ Sikadur®-52 Injection ■ Sika® Injection-201
Durability/Permanent Sealing	<ul style="list-style-type: none"> ■ High durability of the repaired structure ■ Little ageing ■ Permanent repair 	<ul style="list-style-type: none"> ■ No shrinkage with ageing ■ Long-term flexibility ■ Permanent sealing 	<p>High Durability</p> <ul style="list-style-type: none"> ■ Sika® Injection-201 ■ Sikadur®-52 Injection ■ Sika® Injection-29/-304 ■ Sika® InjectoCem-190
Resistance	<ul style="list-style-type: none"> ■ High resistance to aggressive chemicals 	<ul style="list-style-type: none"> ■ Injection systems with high chemical resistance 	<p>High chemical Resistance</p> <ul style="list-style-type: none"> ■ Sika® Injection-201 ■ Sikadur®-52 Injection ■ Sika® Injection-29/-304 ■ Sika® InjectoCem-190
Environmental Hazard/Toxicity	<ul style="list-style-type: none"> ■ Allows injection in ecologically sensitive environments ■ Non-toxic and non-hazardous in application 	<ul style="list-style-type: none"> ■ Solvent-free systems ■ Environmentally friendly raw materials ■ Systems tested for ground water contact 	<p>Environmentally friendly</p> <ul style="list-style-type: none"> ■ Sika® Injection-101/-201 ■ Sikadur®-52 Injection ■ Sika® Injection-29/-304 ■ Sika® InjectoCem-190

The Sika® Injection Systems for the different Applications



Waterproofing of Construction Joints

Sealing of construction joints in concrete structures

Sika® Injection-29

Low viscous, flexible and solvent-free poly-acrylic injection resin with a high solids content. It is used for the injection of the Sika® Injectoflex Hose System.

Sika® Injection-201*

Low viscous, flexible and solvent-free polyurethane injection resin for permanent waterproof sealing of cracks and construction joints. It forms, in contact with water, a uniform, closed and therefore watertight pore structure. The reaction time of Sika® Injection-201 can be accelerated with Sika® Injection-AC20.

Sika® InjectoCem-190

Two-component injection grout for sealing and structural strengthening of cracks and construction joints, based on microcement with added admixtures and corrosion inhibitors. It is also used for the injection of the Sika® Injectoflex Hose System.



Surface Sealing of leaking Concrete Structures

Remedial surface sealing by certain injection of defects in underground building components

Sika® Injection-304

Flexible, very low viscous and very quick-gelling polyacrylic injection gel for permanent watertight sealing of leaking surfaces. The material reacts to form a waterproof, flexible but solid gel with good adhesion to both dry and wet substrates.



Waterproofing of Cracks

Closing, sealing and flexible bridging of leaking cracks in new and existing structures

Sika® Injection-101

Fast foaming, low viscous and solvent-free water-reactive polyurethane injection foam resin for temporary waterstopping. The material cures to a very dense hard-elastic foam with a very fine cellular structure. The reaction time of Sika® Injection-101 can be accelerated with Sika® Injection-AC10.

Sika® Injection-201*

Low viscous, flexible and solvent-free polyurethane injection resin for permanent waterproof sealing of cracks and construction joints. It forms, in contact with water, a uniform, closed and therefore watertight pore structure. The reaction time of Sika® Injection-201 can be accelerated with Sika® Injection-AC20.



Structural Crack and Void Repair

Bridging and filling of cracks and voids where structural strength is required

Sikadur®-52 Injection*

Low viscous, solvent-free, high strength epoxy resin for structural bonding of cracks and voids in dry and damp concrete structures.

Sika® InjectoCem-190

Two-component injection grout for sealing and structural strengthening of cracks and construction joints, based on microcement with added admixtures and corrosion inhibitors.

* other formulation available (Sika® Injection-203) that is tested and approved according to ZTV-RG (RGS) and registered with the BASI-List

Sika's Ecologically Advanced Injection Systems

Sika® Injection systems have been tested by independent institutes with respect to the potential risks concerning water quality, working safety and toxicology. These tests give information on how the liquid materials i.e. immediately after injection, or the hardened/cured material affects the quality of water.

Criteria for Selection of the Sika® Injection Systems

Selection Criteria for Injection Systems to be used in the Repair and Waterproofing of Concrete Structures:

- 1 **Structural strengthening = S Durable elastic sealing = E Temporary sealing = T**
The rheological properties of the injection system and damaged concrete structures determine the most suitable application system.
- 2 **Can accommodate movement after curing**
Non-elastic injection systems can cause subsequent cracking elsewhere.
- 3 **Durable waterproof sealing**
Long-term effectiveness and reliable protection against ground water pressure.
- 4 **Improvement in matrix quality**
The injection system strength is appropriate for repairs to weaker concrete and mortar.
- 5 **Penetrates into fine cracks (e.g. >0.2 mm)**
The low viscosity of the injection material determines the crack penetration and reduces the injection pressure.
- 6 **Not durable**
Suitable for temporary waterproofing against water under pressure.
- 7 **Reacts only in contact with water**
The reaction only takes place when needed.
- 8 **For watertight compartment injection**
Repair by injection of waterproofing membranes (single and double layer systems).
- 9 **Pumpable as a single component system**
Injection systems with long potlives (>20 min) can be pumped with a single-component pump.
- 10 **Only suitable for low pressure injection (<10 bar)**
Low injection pressure prevents separation of microfine cement suspensions.
- 11 **European drinking water approval**
Allows injection in ecologically sensitive environments.
- 12 **Can be accelerated**
Acceleration of the reaction time reduces waiting times during works (especially at cold temperatures) and prevents washing out of the resin.

Notes: Sika® Injection 101 can be used as temporary sealing prior to injecting Sika® Injection 201 for permanent sealing.

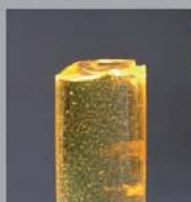
Polyurethane Foams	Polyurethane Resins	Epoxy Resins	Polyacrylate Resins/Gels		Microfine Binders
Sika® Injection-101*	Sika® Injection-201	Sikadur®-52 Injection	Sika® Injection-29	Sika® Injection-304	Sika® InjectoCem-180
T	E	S	E	E	S
	X		X	X	
	X	X	X	X	X
	X	X			X
X	X	X	X	X	X
X					
X					
				X	
X	X	X	X		X
					X
X	X		X	X	
X	X		X		



The free expansion rate of Sika® Injection-101 is up to 40 times.



Due to the low viscosity of Sika® Injection-201 it can penetrate into cracks >0.2 mm in width.



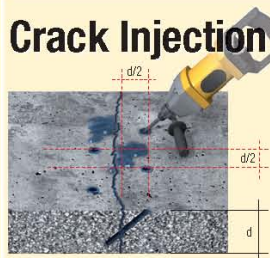
Sikadur®-52 Injection achieves a strength of up to 50 N/mm².



Sika® Injection-304 reacts to form a waterproof, flexible but solid polyacrylic gel.

Application of the Sika® Injection Systems

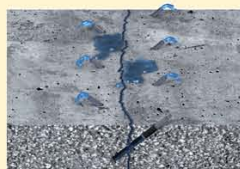
Crack Injection with Mechanical Packers



1. Drill packer holes at a 45° angle to the concrete surface as shown in the figure. \varnothing of drill hole = \varnothing of packer + 2 mm.



2. Install the mechanical packers. Tighten the mechanical packers so that they can withstand the maximum injection pressure.



3. Fix the non-return valve on the first packer and start the injection process.



4. When the injection material flows out of the second packer during the injection process, fix the non-return valve on it as quick as possible. Stop injection at the first packer and continue at the second packer.

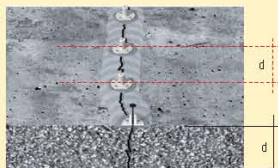
5. Repeat this procedure from packer to packer.

6. If necessary, a secondary injection procedure is carried out to ensure the crack is completely filled and sealed.

Crack Injection with Surface Packers



1. Prepare the substrate by blast cleaning or mechanically by grinding etc., then clean by brush and vacuum.



2. Place a steel nail through the packer into the crack to prevent the injection canal from being blocked by the **Sika® Injection-490** adhesive and then install the surface packers as shown in the figure.



3. Patch the surface of the crack with **Sika® Injection-490**. Ensure that the packer and the crack on the surface are fully covered by the adhesive filler.



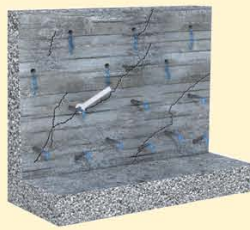
4. As soon as the adhesive has cured, remove the nail and fix the button head fittings (non-return) on the first packer and start the injection process.

5. Continue the injection procedure as for crack injection with mechanical packers (points 4, 5 and 6).

Curtain Injection



1. Drill holes for the mechanical packers through the leaking building component at a distance of 30–50 cm apart as shown in the figure.



2. Install the mechanical packers. Tighten the mechanical packers so that they can withstand the maximum injection pressures.



3. Fix the button head (non-return) fittings on the first packer and start the injection process at the lowest row of drill holes.



4. When the injection material flows out of the second packer during the injection process, fix the non-return valve on it as quickly as possible. Stop injection at the first packer and continue at the second packer.

5. Continue the injection procedure as for crack injection (points 5 and 6).

Important Notes for the Application of Sika Injection Systems:

- The surfaces of voids and cracks need to be clean
- Always work by injecting from the bottom to the top

- Make sure that there is no drainage pipe in or behind the surface
- Always start injection with low pressure

Injection Pumps and Packers for Sika® Injection Materials

Injection Equipment for Sika® Injection Resins and Microfine Cement Suspension

Single-component Pumps for Polyurethane, Polyacrylate and Epoxy Resins



Single-component injection pumps

Two-component Pumps for Polyacrylate Gels



Two-component pump

Mixing and Pumping Equipment for Microfine Cement Suspension



Colloidal mixer

Electric pump

Sika Injection Pump/Mixer	Polyurethane Foams	Polyurethane Resins	Epoxy Resins	Polyacrylate Resins/Gels		Microfine Binders
	Sika® Injection-101	Sika® Injection-201	Sikadur®-52 Injection	Sika® Injection-29	Sika® Injection-304	Sika® InjectoCam-190
EL-1/-2	X	X	X	X		
Hand-1/-2	X	X	X	X		
PN-2C					X	
C-1						X
MFC-1						X
Equipment Cleaning	Sika® Thinner C			Water		

Sika® Injection Packers for different Applications

Sika® Injection Packers are filler necks used as connection pieces between the injection pump and the structure. Sika provides a full range of injection packers. There are two different types of packers:

Mechanical Packers

for high and low pressure injection where hole drilling is possible



Type MPS

Type MPR

Type MPC

Surface Packers

for low pressure injection, where drilling is not possible



Type SP

		Injection Packer				
		Mechanical			Surface	
Application	Concrete Quality	Injection Pressure	MPS	MPR ¹	MPC ²	SP
Crack and Void Injection	Drilling not possible (steel reinforcement)	1 – 10 bar				X
	Good and poor quality (drilling possible!)		X	X	X	X
Injectoflex Injection			X ³	X ³	X ³	
Curtain Injection		10 – 200 bar		X ⁴		
Crack and Void Injection	Good and poor quality (drilling possible!)		X	X		
Injectoflex Injection			X ³	X ³		

¹Recommended for high pressures and high flow rates ²Specially designed for injection with microfine binders ³Just 13 mm diameter ⁴Only with button head (non-return) fitting

Case Studies



Surface Sealing of a Leaking Shaft

Problem

An inadequate waterproofing system had been selected for a concrete shaft standing in groundwater. Water was infiltrating the shaft from several construction joints and damaging the electrical installations.

Injection Material Requirements

- Very fast reacting injection material
- Able to form a new permanent watertight sealing surface
- Environmentally friendly

Sika Solution

Curtain injection with

- Fast reaction polyacrylate gel **Sika® Injection-304**



Sealing of Cracks in a Basement

Problem

A basement garage which is built up of watertight concrete with waterbars, suffered settlement cracks in the structure after construction. Water was infiltrating because the garage was exposed to groundwater pressure.

Injection Material Requirements

First phase:

- Fast foaming injection foam
- Reacts only in contact with water

Second phase:

- Low viscosity
- No shrinkage in subsequent dry conditions
- Good adhesion to concrete
- Environmentally friendly and chemically resistant

Sika Solution

Crack injection with

- Fast reacting polyurethane foam **Sika® Injection-101** for temporary waterstopping
- Elastic polyurethane resin **Sika® Injection-201** for permanent waterproof sealing



Sealing of Damaged Membranes in an Open-cut Tunnel

Problem

An open-cut tunnel below groundwater level was sealed with sheet waterproofing membranes and waterbars. Damage occurred during the construction period and went unnoticed until the tunnel began leaking. Fortunately the damage location was easily identified as the membrane and waterbars were formed into compartments.

Injection Material Requirements

- Permanently elastic
- Able to form a new permanent watertight sealing surface
- Gel time able to be adapted to the specific requirements
- Capable of reversibly absorbing (swelling) and releasing (shrinking) moisture

Sika Solution

Compartment injection through injection pipes with

- Polyacrylate gel **Sika® Injection-304**



Structural Crack Repair of a Bridge

Problem

Cracks with the potential to become a problem for the structural integrity occurred in the support piers of a motorway bridge due to the dynamic loads.

Injection Material Requirements

- Different low viscosities for different crack widths
- High mechanical and adhesive strengths
- Suitable for both dry and damp substrate conditions

Sika Solution

Crack injection with

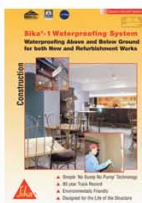
- Low viscous epoxy resin **Sikadur®-52 Injection** for cracks > 0.3 mm

Sika® Injection Systems for Concrete Structures



Sika is a globally active company in the speciality and construction chemicals business. It has subsidiary manufacturing, sales and technical support facilities in over 70 countries around the world. Sika is THE global market and technology leader in waterproofing, sealing, bonding, dampening, strengthening and the protection of buildings and civil engineering structures. Sika has approx. 12000 employees worldwide and is therefore ideally positioned to support the success of its customers.

Also available from Sika



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